

CLAIMS

What is claimed is:

1. A differential system comprising:
a rotatable case defining an interior cavity;
a pair of pinion gears rotatably supported in said interior cavity;
a pair of side gears rotatably supported in said interior cavity, wherein each of said pinion gears drivingly engages each of said side gears; and
an electrically operable coupling including a moveable electromagnet and a non-magnetic spacer coupled thereto, said coupling being operable to selectively connect one of said side gears to said case in response to movement of said electromagnet toward said side gears, said spacer positioning the electromagnet to reduce a force urging said coupling away from said side gears.
2. The differential system of claim 1 wherein said spacer limits the travel of said coupling away from said side gears.
3. The differential system of claim 2 further including a ring selectively engageable with said one of said side gears, said ring being rotationally retained by said case and axially moveable relative to said case.
4. The differential system of claim 3 wherein said case includes a removable cap, said spacer being positioned between said cap and said ring.

5. The differential system of claim 4 wherein said cap includes a recess within which a portion of said coupling is positioned.

6. The differential system of claim 5 further including a spring biasing said ring toward a position disengaged from said first side gear.

7. The differential system of claim 6 wherein said pinion gears rotate about a first common axis and wherein said first and second side gears rotate about a second common axis, said first common axis being positioned substantially orthogonal to said second common axis.

8. The differential system of claim 6 wherein said pinion gears rotate about axes parallel to and offset from one another.

9. The differential system of claim 1 wherein said case includes a portion positioned on an opposite side of said coupling as said pair of side gears, wherein during energization of said electromagnet, said electromagnet is attracted toward said portion of said case by a force less than a force attracting said electromagnet toward said side gears.

10. A differential system comprising:

a case defining an interior cavity, said case having a bore communicating with said interior cavity;

a pair of pinion gears positioned within said interior cavity and rotatably coupled to said case;

first and second side gears positioned within said interior cavity in meshing engagement with said pinion gears and rotatably coupled to said case;

an electromagnetic actuator having a coil moveable within said bore between an engaged position and a disengaged position, said case being drivingly coupled to said first side gear when said coil is in said engaged position;

a spring biasing said actuator toward said disengaged position; and

a spacer coupled to said actuator, said spacer defining the position of said actuator relative to said engaged position, wherein a force attracting said actuator toward said engaged position is greater than a force provided by said spring and a force attracting said actuator toward said disengaged position such that said actuator moves toward said engaged position when an electrical current is passed through said coil.

11. The differential system of claim 10 wherein said electromagnetic actuator includes an axially slidable ring coupled to said coil, said ring being selectively engageable with said first side gear.

12. The differential system of claim 11 wherein said spacer is integrally molded to said ring to define a unitary component.

13. The differential system of claim 11 wherein said ring includes a plurality of dogs that are selectively engageable with a plurality of dogs extending from said first side gear.

14. The differential system of claim 11 wherein said spacer includes a plurality of spaced apart pads coupled to said ring.

15. A differential system comprising:
a rotatable case defining an interior cavity;
a pair of pinion gears rotatably supported in said interior cavity;
a pair of side gears rotatably supported in said interior cavity, wherein each of said pinion gears drivingly engages each of said side gears; and
an electrically operable coupling including a moveable electromagnet and a non-magnetic spacer coupled thereto, said coupling being operable to selectively connect one of said side gears to said case in response to movement of said electromagnet, said spacer maintaining at least a predetermined distance between said coupling and a magnetizable portion of said case.

16. The differential system of claim 15 wherein said magnetizable portion of said case is positioned on an opposite side of said coupling as said pair of side gears.

17. The differential system of claim 16 wherein said coupling includes an axially slidable ring engageable with one of said side gears and wherein said spacer is coupled to said ring.

18. The differential system of claim 17 wherein said spacer includes a plurality of spaced apart pads coupled to said ring.

19. The differential system of claim 18 further including a spring biasing said ring toward a position disengaged from one of said side gears.

20. The differential system of claim 19 wherein said spacer is engaged with said magnetizable portion of the case when said ring is in said position disengaged from one of said side gears.

21. The differential system of claim 17 wherein said spacer is molded to said ring to define a unitary member.